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February 11, 2003

Mr. Dan Rosenblatt  
Emergency Response Team (7505C)  
U.S. Environmental Protection Agency  
Ariel Rios Building  
1200 Pennsylvania Avenue, NW  
Washington, D.C. 20460

Subject: Application for an Emergency Specific Exemption  
Carbofuran/Cotton/Cotton Aphid

Dear Mr. Rosenblatt:

The Texas Department of Agriculture (TDA) hereby makes application for an emergency specific exemption to authorize the use of carbofuran (FURADAN 4F Insecticide/Nematicide, EPA Reg. No. 279-2876) to control cotton aphids in the production of cotton in Texas on 1,800,000 acres. Significant economic losses have occurred due to this pest in the past. Because emergency conditions have developed due to resistance of this aphid to many registered products in the past, it is anticipated that this cotton aphid has the potential to develop resistance to the newly registered products if repetitive applications are applied on a continuing basis. Historically, when products are applied in this manner, aphids have always developed a tolerance until those products have become ineffective. If conditions are suitable for aphid populations to thrive, this could be a major problem in the future if not this year.

Cotton grower organizations have requested that Furadan 4F be available one more year for 2 reasons. First, the neonicotinoid class of chemistry has not proven to be immune to the development of resistance by such notorious insect pests as aphids. Research studies in the lab/greenhouse have confirmed that after repeated applications of the newly registered products, aphid resistance can occur. Consequently, the labels of both new products request alternative chemistry to be used in conjunction with each product as a rotation to delay the development of resistance as outlined in the "Resistance Management" section of their labels. Additionally, growers are afraid they may not be able to maintain the crop quality they are known for if aphid populations are not controlled and sticky cotton becomes a problem.

Thiamethoxam was approved by the US EPA in 2001 and provided aphid control during the 2002 use season as did acetamiprid. Both compounds however belong to the chloronicotinyl class of insecticides and have the potential of creating an aphid population with resistance to that class of insecticide and perhaps others as noted by research. The application provides additional discussion on the resistance management strategy.

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I assume the procedures from last year remain the same. Since you indicated last year that if there were no changes from the previous year, a letter for this repeat application was all that was needed. There are no changes from the last EPA notification, which allowed the use of carbofuran on cotton (refer to file symbol 01-TX-05). The only change from the 2002 program involves when the product will be released for use. The details for this procedure follow recommendations in a letter from Dr. Leser as attached.

A map of the affected counties is included for your review along with support and informative letters from Plains Cotton Growers, Inc., South Texas Cotton and Grain Association, Inc., Texas Cotton Producers, Inc., and also Dr. Jim Leser of Texas A&M Cooperative Extension Service. We trust that you will agree with our assessment and will be able to act expeditiously on this application.

Sincerely,



Phil Tham  
Assistant Commissioner  
Pesticide Division

PT/TM/eg

Enclosures

cc: Mr. Johnie Dowell, EPA Region VI  
Dr. Rodney Holloway, Texas Cooperative Extension Service  
Dr. Pat Morrison, Texas Cooperative Extension Service  
Mr. Jack McDaniel, FMC Corporation  
Dr. Terry Mize, FMC Corporation

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**SECTION 2**  
**REQUIREMENTS OF 40 CFR 166.20(a,b)**  
**FINAL REPORT**

## 2003 FIFRA SECTION 18 EMERGENCY EXEMPTION APPLICATION

General Information requirements of 40 CFR 166.20(a,b) in an application for a specific exemption.

### TYPE OF EXEMPTION BEING REQUESTED

√ SPECIFIC

QUARANTINE

PUBLIC HEALTH

### SECTION 166.20(a)(1): IDENTITY OF CONTACT PERSONS

#### Section 166.20(a)(1)(i)

This application to the Administrator of Environmental Protection Agency (EPA) for a specific exemption to authorize the use of carbofuran (FURADAN 4F Insecticide/Nematicide) on cotton to control cotton aphids is submitted by the Texas Department of Agriculture. Any questions related to the content of this document may be directed to the registration specialist responsible for its preparation as follows:

Ed V. Gage  
Texas Department of Agriculture  
Registration Specialist  
Pesticide Registration Program  
P.O. Box 12847  
Austin, Texas 78711  
(512) 463-7544  
Fax # (512) 463-7411      email: ed.gage@agr.state.tx.us

In the event Mr. Gage is not available, questions may also be directed to:

Mr. Terry Mitchell  
Director, Pesticide Programs  
Texas Department of Agriculture  
Austin, Texas 78711  
(512) 463-7545

**Section 166.20(a)(1)(ii)**

The following qualified experts are also available to answer questions that may arise:

Dr. Roy Parker  
Extension Entomologist  
Texas Agricultural Extension Service  
(512) 265-9203

Dr. Jim Leser  
Extension Entomologist  
Texas Agricultural Extension Service  
(806) 746-6101

<b>SECTION 166.20(a)(2): DESCRIPTION OF PESTICIDE REQUESTED</b>
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**Section 166.20(a)(2)(ii)**

The product for which this specific exemption is being sought is carbofuran (FURADAN 4F Insecticide/Nematicide, EPA Reg. No. 279-2876).

**Common Chemical Name**

(Active Ingredient): Carbofuran

**Trade Name(s)**

and EPA Reg. Nos.: FURADAN 4F Insecticide/Nematicide (EPA Reg. No. 279-2876)

**Formulation:** Flowable Liquid % **Active Ingredient:** 44.0

**Manufacturer(s):** FMC Corporation

<b>SECTION 166.20(a)(3): DESCRIPTION OF PROPOSED USE</b>
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**Sites to be treated:**

Sites include all cotton producing counties in Texas.

**Method of Application:**

By ground or aerial equipment.

**Rate of Application:**

Product may be applied at the rate of 0.25 lb ai/a (8 fluid ounces) in a minimum of 5 gallons of finished spray per acre by air or 10 gallons of finished spray per acre by ground application.

The product may be applied no more than twice during the growing season which translates to a maximum of 0.5 pounds of active ingredient (16 fluid ounces) per acre, in the 2003 growing season.

**Maximum Number of Applications:**

Two, (2).

**Total Acreage to be treated:**

Texas Agricultural Extension Service entomologists have estimated that 35% of the cotton grown in Texas could suffer significant economic losses due to aphid infestation. Therefore, a maximum of 1.8 million acres (which is approximately 35% of the 1997 harvested acreage in Texas, 5.15 million acres) may require treatment.

**Total Amount of Pesticide to be used:**

If all of the 1.8 million acres were treated using the maximum rate of 0.5 pounds active ingredient (16 fluid ounces) per acre, then a maximum of 900,000 pounds of the active ingredient, or 225,000 gallons of FURADAN 4F Insecticide/Nematicide would be required.

**Use Season:**

The use period is April 1, 2003 to October 31, 2003.

**Section 166.20(a)(3)(vi)**

All applicable restrictions and requirements concerning the proposed use and the qualifications of applicators using carbofuran (FURADAN 4F Insecticide/Nematicide) are as follows:

- The product, FURADAN 4F Insecticide/Nematicide, manufactured by FMC Corporation, may be applied. All applicable directions, restrictions and precautions on the EPA registered product label for FURADAN 4F Insecticide/Nematicide must be followed.
- FURADAN 4F Insecticide/Nematicide shall be applied only by certified applicators, licensed applicators or by persons under the direct supervision of licensed applicator. The licensed applicator must be certified in the category applicable to the application of restricted use pesticides in cotton for insect control.
- The 1998 suggestions for Cotton Aphid Management in West Texas must be followed. The section concerning the prerequisites to the release of the product in each extension district as taken from the above guidelines are as follows:

Flowable carbofuran may be used under this exemption either as an early-season (pre-bloom) treatment, or as a mid- to late- season ("plant growth stage") treatment.

Early season is defined as the period when the cotton plants have developed their sixth (6th) set of leaves until they bloom. During this period, if a registered alternative product has been used and has not controlled the aphid infestation, flowable carbofuran may be applied when aphid populations reach the treatment threshold of 50 aphids per leaf as determined by the following sampling plan:

Sample 1 top leaf (first fully expanded leaf) and 1 mid leaf per plant on 5 randomly selected plants 100 feet from edge of field. Repeat in each of the four quadrants of the field until a total of 40 leaves are collected. Treat only if aphid populations exceed an average of 50 per leaf.

Plant growth stage (mid season) is defined as the period beginning when the cotton plants have bloomed. During this period, if a registered alternative product has been used and has not controlled the aphid infestation, flowable carbofuran may be applied when aphid populations reach the treatment threshold of 100 aphids per leaf as determined by the following sampling plan:

Sample 1 top leaf (first fully expanded leaf) and 1 mid leaf (5 nodes below "top" leaf) per plant on 5 randomly selected plants 100 feet from edge of field. Repeat in each of the four quadrants of the field until a total of 40 leaves are collected. Treat only if aphid populations exceed an average of 100 per leaf.

When 5% of the bolls in a field have opened, that field may be treated when a threshold of 15 aphids per leaf is identified. To determine the number of aphids per leaf, use the sampling plan as described in the following sampling plan:

Sample 1 top leaf (first fully expanded leaf) and 1 mid leaf (5 nodes below "top" leaf) per plant on 5 randomly selected plants 100 feet from edge of field. Repeat in each of the four quadrants of the field until a total of 40 leaves are collected. Treat only if aphid populations exceed the averages stated above depending on condition of the bolls.

State pesticide authorities or crop consultants must document resistance and infestation levels before "prescribing" foliar use on cotton.

- **DO NOT APPLY FURADAN 4F Insecticide/Nematicide within 27 days of harvest.**
- **DO NOT feed cotton forage.**

- Due to the high toxicity of FURADAN 4F Insecticide/Nematicide to avian species, end users of FURADAN 4F Insecticide/Nematicide are obligated to monitor their cotton fields and report all known incidents of avian mortality resulting from use of product to the Texas Department of Agriculture.

**The emergency use of FURADAN 4F Insecticide may be initiated in cotton fields that meet the criteria described in the EPA guidelines for Section 18 exemptions for the use of flowable carbofuran on cotton. This is described as follows:**

- There are twelve Texas Agricultural Extension Service Districts in Texas that roughly follow natural regions (areas) within the state. Documentation or written correspondence will be submitted with this application from these various areas by professional entomologist (Section 9). Treatment failures by the registered alternatives described by these entomologists are attributable to resistance (also see Section 5 for efficacy studies indicate resistance problems). This documentation will represent all the cotton grown in that particular extension district and will be reported by these entomologists to the Texas Department of Agriculture.
- In regard to stewardship, the Texas Agricultural Extension Service has a vast network of communication across the state via **newsletters, radio programs, field day programs**, etc. This resource will be utilized to encourage growers to develop long-range resistance management strategies for aphid control and any new chemical controls, as they are made available.
- Flowable carbofuran may be used only after aphid populations reach the following treatment thresholds: On cotton, early season and mid-season, 100 aphids per leaf must be present; when 5% of the bolls in a field have opened, that field may be treated when a threshold of 15 aphids per leaf is identified. To determine the number of aphids per leaf, use the following sampling plan:

Sample 1 top leaf (first fully expanded leaf) and 1 mid leaf (5 nodes below "top" leaf) per plant on 5 randomly selected plants 100 feet from edge of field. Repeat in each of the four quadrants of the field until a total of 40 leaves are collected. Treat only if aphid populations exceed the averages stated above depending on the growth stage of the plant.

- As a provision to address worker protection, **APPLICATORS MUST USE** only closed mixing and loading systems for both aerial and ground application equipment.
- **APPLICATORS MUST USE** appropriate Personal Protective Equipment (PPE) (gloves, respirator and goggles) for emergency repair and maintenance activities.
- **The Farm Operator is responsible for posting treated fields. An EPA, WPS warning flag(s)/sign(s) at points of access around the treated cotton field with the name of the**

**pesticide, date of application and what day the reentry interval ends for the treated field can be used as a method of posting.**

- **APPLICATORS MUST USE** measures developed by the Spray Drift Task Force to reduce spray drift to non-target areas for aerial applications to cotton. These measures will be distributed with the EPA notice of approval for this specific exemption.
- The Texas Department of Agriculture, as required by 166.20(a)(8) of 40 CFR, has notified interested Federal/State Agencies, including the U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department due to concerns of migratory and threatened and endangered species.
- The following buffer strips are recommended for applications of flowable carbofuran where these threatened and endangered species occur:

Bald Eagles: 1 mile from active nests

**ALL OTHERS AT THE EDGE OF HABITAT CURRENTLY BELIEVED TO BE OCCUPIED BY THE FOLLOWING:**

Other terrestrial species: 100 yards for ground applications  
1/4 mile for aerial applications

Aquatic species: 20 yards for ground applications  
100 yards for aerial applications

## **SECTION 166.20(a)(4): ALTERNATIVE METHODS OF CONTROL**

### **Section 166.20(a)(4)(i):**

Although numerous products are currently registered for use on cotton for control of cotton aphid, these products historically have not provided the level of control that may be obtained with Furadan 4F. Although exhaustive testing in Texas over the last few years has identified effective insecticidal controls, they were not readily available in the past. Additional research in 2002 has indicated that some newly registered products provided economic control of cotton aphid. Up until last year, the registered product, BIDRIN seemed to have the best potential for control and has been used along with other products throughout the state of Texas, with unfortunately poor results. In direct comparisons FURADAN 4F Insecticide resulted in equal or better cotton aphid control than BIDRIN. Although some direct comparisons did not reflect yield differences or net returns per acre, field experiences have indicated otherwise.

Personal communication in 1998, with numerous extension entomologists and professional crop consultants from four major cotton producing regions of Texas (Winter Garden, Blacklands, Rolling Plains and Trans-Pecos areas) reported using as many as 4-5 applications of currently registered products, including BIDRIN, because control only lasted 3-6 days. Crop consultants and producers, particularly in the Winter-Garden area and the Blacklands were extremely concerned at the time not only because of potential yield loss but also the grade of cotton due to "sticky lint".

More recently however, communication about aphid control during 2002 with extension entomologists in Texas indicated the use of the newly registered products reduced the overall number of aphid control applications to usually one or rarely two. Aphid control can now generally be achieved as easily with the neonicotinoid products as with carbofuran. The main justification for requesting Furadan 4F, is to allow growers the option to use alternative chemistry in a rotation strategy for "resistance management."

The inconsistencies between plot test results of currently registered products and actual field conditions are obvious when you look at yield losses and control costs due to multiple applications of these products. In 1991 the apparent resistance to the registered products by cotton aphids in Texas resulted in yield loss estimates of 88 million dollars and additional control costs of 25 million dollars. Two recently labeled pesticides that must be considered for aphid control, at this time, are naled (DIBROM 8E) and imidacloprid (ADMIRE 2F and PROVADO 1.6). Valent, the manufacturer of DIBROM 8E has not marketed their product for this use in Texas and it has not been tested in Texas for controlling aphids. There have been studies with PROVADO 1.6 for aphid control in Texas. These studies have been reviewed and indicate inconsistent performance or results comparable with the more widely used registered alternatives (economically damaging aphid resurgence in a short period of time). These control failures have also been documented under actual field conditions. These results are of special concern because it shows at least one product in the neonicotinoid class of chemistry shows inconsistent results. The other two products in this class (acetamiprid and thiamethoxam) shows improved control but both product labels recommend against consecutive or repeated

applications to the same population or multiple generations under a "Resistance Management" section. They also recommend rotating to a different insecticide class on successive generations. The carbamate: Furadan 4F, would continue to provide effective control and also provide the rotation element that would make it difficult for the aphid to quickly develop resistance to either class of insecticides. This technique of chemical class rotation has been effective in delaying resistance in other hard-to-control insect groups.

**Section 166.20(a)(4)(ii):**

Alternative management practices, both short term and long term, for controlling cotton aphids in Texas were developed by the Texas Agricultural Extension Service and Texas Agricultural Experiment Station scientists based on the biology and ecology of cotton aphids and include cultural and insecticide resistant management techniques. Although these alternative practices help in reducing cotton aphid populations they are not sufficient to prevent economic losses due to this pest once aphid resistance occurs. A fungus, and various beneficial insects are known to effectively cause an aphid population to "crash," but very high levels are needed however and often times don't occur in a timely manner. Some research is being done on juvenile growth hormones to control aphids but this approach is still in the research stage. At this time the alternative products to control the cotton aphid are restricted to a limited number of applications as recommended by the manufacturer on the label under a "resistance management" section.

**SECTION 166.20(a)(5): EFFECTIVENESS OF PROPOSED USE**

Research data shows the efficacy of carbofuran to cotton aphids. It should be noted that in one field bioassay study for carbofuran, the LC<sub>95</sub> values for cotton aphids were 43X that previously reported for methomyl (reported in 2002 application). The rotation of chemical classes appears in the resistance management strategy of both of the newly labeled products. The use of the carbamate: Furadan 4F, will fit that proposed use strategy.

**SECTION 166.20(a)(6): DISCUSSION OF RESIDUES FOR FOOD**

Residue studies submitted by FMC Corporation have been received. It has been determined that residues resulting from applications made under this exemption, are not expected to exceed 1.0 ppm of the insecticide carbofuran (of which no more than 0.2 ppm is carbamates) in or on the raw agricultural commodity, cottonseed.

**SECTION 166.20(a)(7): DISCUSSION OF RISK INFORMATION**

Carbofuran (Furadan 4F) is a broad-spectrum carbamate insecticide/nematicide, with registered uses on a variety of fruit and field crops, vegetables, tobacco, ornamental and forest tree

seedlings. This discussion of risk information evaluates the impact of carbofuran use on cotton crops to control aphids in 122 Texas counties as delineated here in this FIFRA Section 18 Emergency Exemption Application.

## **HUMAN HEALTH**

### **Toxicology**

Technical carbofuran exhibits high acute toxicity in mammals. Oral and dermal median lethal doses (LD<sub>50</sub>s) in rat and rabbit were 6.4-14 and 14.7 mg/kg, respectively. LD<sub>50</sub> of Furadan 4F formulation was 38 mg/kg. Carbofuran does not cause eye or skin irritation in test animals. A three-generation reproductive study in rats showed no adverse effects at a dose of 1 mg/kg/day. No developmental effects or observable clinical signs of toxicity were reported in rats fed carbofuran up to 9.7 mg/kg/day. Maternal body weight gains were reduced at dosages of 2.9-9.7 mg/kg/day. Data do not suggest mutagenic or chromosomal effects, except for one CHO V79 cell S-9 activation test that showed positive results at an unspecified dosage of carbofuran.

Carbofuran is rapidly absorbed, distributed, and metabolized to phenolic, hydroxy or keto derivatives of carbofuran. The chemical and its metabolites (about 72%) are excreted in the urine within 24 hr of exposure.

Long-term effects of carbofuran in humans are not known. In lifetime dietary exposure studies in rats and mice, there was no evidence of carcinogenicity. Rats were exposed to 0.5, 1 or 5 mg/kg/day of dietary carbofuran, whereas mice received a dietary dose of 3, 18.8 or 75 mg/kg/day. Chronic exposure studies in dogs showed significant ChE inhibition above a dose of 0.5 mg/kg/day.

### **Risk Assessment**

Since carbofuran showed no evidence of oncogenic potential in animal studies, EPA has not classified the chemical for oncogenicity. Based on a one-year dog feeding study, EPA had determined a no-observable-adverse-effect-level (NOAEL) of 0.5 mg/kg/day for plasma and RBC cholinesterase inhibition. Using a safety factor of 100, an oral RfD (reference dose) of 0.005 mg/kg/day has been calculated. This allows a maximum permissible daily intake without any adverse health effects of 0.35 mg for an adult weighing 70 kg.

Carbofuran has an EPA-established tolerance level on cottonseed of 1 ppm. Foliar application recommends that Furadan 4F be used at the rate of 0.25 lb in a minimum of two gallons of finished spray per acre. It is unlikely that this mode and rate of application would significantly exceed the residue tolerance in cottonseed. Cotton requires tolerances because cottonseed, meal and/or oil, is a dietary component. Children (ages 1-6 yrs) are the most susceptible population because they consume a higher proportion of cottonseed per kg body weight. Assuming residue levels of carbofuran at tolerance levels (worst-case scenario) exposure would be to about 0.037 ug/kg/day or less than 1% of the RfD. Thus, it is unlikely that this population or any population would be exposed to an unacceptable risk.

Residues of carbofuran would not be expected to appear in drinking water. The Texas Commission on Environmental Quality (TCEQ) monitored drinking water for carbofuran for several years without detections. The likelihood of residues of carbofuran in drinking water is considered extremely low and the TCEQ no longer monitors for this pesticide in drinking water.

Since acute dermal, ocular, and inhalation exposure to carbofuran can occur during regular handling and application procedures, proper worker safety precautions should be observed as provided in the label. This will reduce the potential worker exposure. Exposure limit (8-hr) established by OSHA for carbofuran is 0.1 mg/m<sup>3</sup> in an occupational setting. A minimum 14 day reentry interval applies after each use of Furadan 4F because of possible high dermal toxicity (Category I) as established under federal Worker Protection Standards.

## **THREATENED AND ENDANGERED SPECIES**

### **Mammals**

Two federally endangered feline species are found within the proposed area. The jaguarundi (*Felis yagouaroundi cacomitli*) has been reported in Willacy County and Cameron County, while the ocelot (*Felis pardalis*) has been reported throughout South Texas. These animals require specialized habitats of very dense mature native brush with a closed canopy. The characteristic differences between their habitat and the farmed areas reduce the possibility of exposing these species to Furadan 4F.

### **Aves**

The following is a summary of the federally protected avian species which occur in the counties where the use of Furadan 4F on cotton is proposed. The American peregrine falcon (*Falco peregrinus anatum*) is a migratory bird that occurs statewide during fall and spring migration, and there are reports of these falcons nesting in the Trans-Pecos region where there are high, massive cliffs, preferably near water. Arctic peregrine falcons (*Falco peregrinus tundrius*) may also occur statewide during migration periods, with a few wintering along Texas' Gulf Coast. Brown pelicans (*Pelicanus occidentalis occidentalis*) live along the Gulf Coast and on coastal islands, but nesting sights are reportedly limited to Calhoun, Matagorda, Nueces, Refugio, and San Patricio counties. Another species that winters along the coast is the interior least tern (*Sterna antillarum athalassos*). This species prefers areas of low vegetative cover and coarse soils along waterways. Piping plovers (*Charadrius melodus*) are very similar with respect to habitat characteristics and winter range distribution. Although they may be found statewide during migration, piping plovers congregate along the coast during winter. Whooping cranes (*Grus americana*) migrate through the state in October-November (southward) and April-May (northward) and have established winter habitat in Aransas, Calhoun, and Refugio counties.

Both the black-capped vireo (*Vireo atricapillus*) and the golden-cheeked warbler (*Dendroica chrysoparia*) are migratory birds that have habitat in some of the counties involved in this Section 18 request. Golden-cheeked warblers require rather dense stands of Ashe juniper-deciduous oak mixture with at least 50% canopy cover. They are present in Texas from early

March to mid-August. Black-capped vireos principally choose areas composed of dense clumps of low-growing vegetation having thick foliage within four feet of the ground. This woody vegetation usually covers less than 50% of the total land and is interspersed with open areas. Black-capped vireos breed in Texas from mid-March through mid-August.

The red-cockaded woodpecker (*Picoides borealis*) is one of only two endangered year-round resident birds with habitat within the proposed area. This species occurs in the following counties: Cherokee, Shelby, Nacogdoches, Houston, San Augustine, Sabine, Angelina, Trinity, Polk, Tyler, Jasper, Newton, Walker, San Jacinto, Montgomery, Liberty, and Hardin. Red-cockaded woodpeckers inhabit old growth pine forests that do not have thick understories. The second endangered bird that remains in Texas throughout the year is the Attwater's prairie chicken (*Tympanuchus cupido attwateri*). This species uses short, mid, and tall grass prairies for different activities such as nesting, feeding, and escape. Attwater's prairie chickens have populations in Austin County, Colorado County, Galveston County.

Also within the area of possible Furadan use is the bald eagle (*Haliaeetus leucocephalus*). Its activities are concentrated along major reservoirs and rivers. None of the species listed above typically frequent cotton fields. Though Attwater's prairie chickens once did, the remaining limited populations are not in cotton growing areas.

In the past, most of the concern regarding carbofuran has been focused on its very high toxicity to birds. Studies have shown that bird mortality can be problematical with the granular form of this insecticide due to both direct exposure and indirect exposure. However, Furadan 4F, the flowable formulation, has no recorded bird kills with the enforcement program of the Texas Department of Agriculture (TDA). Post treatment sampling by TDA has found little or no impact to birds.

### **Invertebrates**

There are seven endangered invertebrates that have habitat within the area of proposed Furadan 4F use. These species inhabit "Karst" terrain that features subsurface formations such as sinkholes and caves. The Bee Creek Cave harvestman (*Texella reddelli*), the Bone Cave harvestman (*Texella reyesi*), the Coffin Cave mold beetle (*Batrisodes texanus*), the Kretschmarr Cave mold beetle (*Texamaurops reddelli*), the Tooth Cave pseudoscorpion (*Microcreagris texana*), the Tooth Cave spider (*Neoleptoneta myopica*), and the Tooth Cave ground beetle (*Rhadine persephone*) are all found in Travis County, while only the Tooth Cave mold beetle has additional habitat in Williamson County. These species require a damp (but not flooded) environment, which is provided by the drainage of water into the subsurface. Though water quality may be influenced by local pesticide use, the karst areas where these endangered invertebrates live is upstream of the application sites. Care should be taken not to allow this insecticide to contaminate any water source through drift or runoff.

### **Fish/reptiles**

There are six endangered aquatic species listed in the given counties. The Comanche Springs pupfish (*Cyprinodon elegans*) inhabits springs, streams, and irrigation ditches around

Toyahvale and also San Solomon Springs, all of which are located in Reeves County. Another pupfish, the Leon Springs pupfish (*Cyprinodon bovinus*), has habitat within Pecos County. It exists in Leon Creek and Diamond Y Springs. The Pecos gambusia (*Gambusia nobilis*) occurs within both Reeves County and Pecos County in small, shallow springs and irrigation ditches which have dense vegetation. The fountain darter (*Etheostoma fonticola*) inhabits the headwaters of both the Comal River and the San Marcos River, which are within Comal County and Hays County. The San Marcos gambusia (*Gambusia georgei*) is only known from the upper San Marcos River in Hays County. The most at risk of this group (those in the San Solomon Spring) are protected by buffer agreement.

The Concho water snake (*Nerodia harteri paucimaculata*) is believed to be distributed discontinuously along the Colorado and Concho rivers throughout ten counties--eight of which are within the area of possible Furadan 4F use. They are Tom Green, Concho, Coleman, Lampasas, Mills, Runnels, Tom Green, and McCulloch counties.

Water usage, not pesticide use, is thought to be the largest factor influencing these species; however, because carbofuran is extremely toxic to aquatic organisms, utmost caution must be used to ensure that this product does not contaminate any aquatic environment.

## **Amphibians**

Hays County also contains habitat for two amphibians, the San Marcos salamander (*Eurycea nana*) and the Texas blind salamander (*Typhlomolge rathbuni*). The San Marcos salamander's habitat extends from the San Marcos spring to a few hundred feet downstream. The Texas blind salamander resides in the underground aquifer system of the Edwards Plateau. These creatures occur upstream of application sites. Another endangered amphibian, the Houston toad (*Bufo houstonensis*), occurs in Leon, Robertson, Milam, Burleson, Lee, Bastrop, and Austin counties. This species requires deep, sandy soils for aestivation and standing pools of water for breeding/tadpole growth. The breeding period for this species begins in January and concludes by July, the proposed starting date for application of Furadan 4F. Another water-dwelling species, which is found in both Brown and Lampasas Counties, is the Concho water snake (*Nerodia harteri paucimaculata*). Contamination of surface and underground water, whether from drift or runoff, must be avoided in order to protect these species from potential harm. Little or no cotton is grown in these areas.

## **Plants**

Furadan 4F is not phytotoxic when used according to label. However, this insecticide is toxic to bees and other pollinators. Reproductive harm to threatened or endangered plants could occur if these species do not have an adequate number of available pollinators.

Many endangered and threatened plants are protected by their selected habitat or their blooming periods do not coincide with cotton production. There are seventeen threatened or endangered species distributed throughout the counties where cotton is produced. Out of these, only four

flower during the period from late March through September 30 when carbofuran may be applied. Walker's manioc (*Manihot walkerae*) blooms March-April and September-October. The landowner voluntarily protects the population in Hidalgo County, and the other known population is on federal land in Starr County. Sneed pincushion cactus (*Coryphantha sneedii* var. *sneedii*) flowers from April to September. This species is known from El Paso County and its habitat is described as cracks on vertical cliffs or ledges of limestone mountains. Texas ayenia (*Ayenia limitaris*) is known from a single population in Hidalgo County within the Rio Grande floodplain. This shrub flowers in response to rain throughout the year. South Texas ambrosia (*Ambrosia cheiranthifolia*) is an endangered plant with habitat in Kleberg and Nueces counties. This species flowers in the late summer to early fall, but is pollinated by the wind not insects.

### Environmental concerns

Carbofuran has the potential to adversely affect wildlife and other natural resources. It is critical that this insecticide is not applied directly to water or to areas where runoff may occur. Similarly, attention should be given to weather conditions in order to prevent drift.

## BENEFICIAL ORGANISMS

### Plants

The application of carbofuran will not adversely affect plants when used as directed as the mode of action prevents this. Its indirect effect, if any, may be on production through pollinator depletion, as this compound is highly toxic to bees (LD<sub>50</sub> is 0.16 µg/bee) and other insects.

### Mammals

Technical carbofuran exhibits high acute toxicity in mammals. Oral and dermal median lethal doses (LD<sub>50</sub>s) in rat and rabbit were 6.4-14 and 14.7 mg/kg, respectively. LD<sub>50</sub> of Furadan 4F formulation was 38 mg/kg. Carbofuran does not cause eye or skin irritation in test animals. A three-generation reproductive study in rats showed no adverse effects at a dose of 1 mg/kg/day. No developmental effects or observable clinical signs of toxicity were reported in rats fed carbofuran up to 9.7 mg/kg/day. Carbofuran is rapidly absorbed, distributed, and metabolized to phenolic, hydroxy or keto derivatives of carbofuran. The chemical and its metabolites (about 72%) are rapidly excreted in the urine within 24 hr of exposure. In lifetime dietary exposure studies in rats and mice, there was no evidence of carcinogenicity. Rats were exposed to 0.5, 1 or 5 mg/kg/day of dietary carbofuran, whereas mice received a dietary dose of 3, 18.8 or 75 mg/kg/day. Chronic exposure studies in dogs showed significant ChE inhibition above a dose of 0.5 mg/kg/day.

### Birds

Carbofuran is highly toxic to avian species, with a varying degree of species sensitivity. Acute oral LD<sub>50</sub> for the powder form for chickens was noted as 25-39 mg/kg. The LD<sub>50</sub>s reported

were for mallard 0.4-0.5 mg/kg, fulvous whistling duck 0.24 mg/kg, red-winged blackbird 0.42 mg/kg, house sparrow 1.3 mg/kg, common grackle 1.33 mg/kg, rock dove 1.33 mg/kg, coturnix quail 3.16 mg/kg, ring-necked pheasant 4.15 mg/kg, northern bobwhite 5.04 mg/kg, and starling 5.62 mg/kg. Avian subacute dietary LC<sub>50</sub>s were 21-190 ppm for 5-7 days old mallards, 158-681 ppm for 5-14 days old northern bobwhites, 438 ppm for Japanese quail, and 573 ppm for ring-necked pheasant. The 10-day dietary LC<sub>50</sub> of 10% granular formulation for pheasants was 960 mg/kg. Upland nesting birds such as quail, foraging sandhill cranes, Aplomado falcon, laughing gulls and swallows are attracted to dead or dying insects inhabiting the cotton fields, or treated plant or contaminated tissue, and may pose a potential for exposure. EPA issued a comprehensive assessment for carbofuran. However, cotton aphids are not an attractive diet and many bird species do not seem to readily perch on grown cotton plants. Exposed granules are reported to be more attractive and hazardous to birds than the flowable concentrate of carbofuran. Mortality of birds in nesting habitats due carbofuran exposure has been reported in the literature. Intensive monitoring of Furadan 4F treated cotton fields in Texas following the 48 h reentry interval showed no detectable avian mortality during 1975-76. This may suggest a significant variability in stressor effects due to environmental and habitat differences.

### **Fish and Aquatic Organisms**

Carbofuran is toxic to fish and aquatic invertebrates. The 96 h LC<sub>50</sub>s for bluegill sunfish and rainbow trout were 0.24 and 0.28 mg/l, respectively. It is moderately toxic to fresh water invertebrates; LC<sub>50</sub>s noted to be 9.8-38.6 ppb. Bioaccumulation potential for carbofuran is noted to be low.

### **Ecological Concerns**

Carbofuran is an acute toxin that inhibits cholinesterase and stimulates central, parasympathetic and somatic motor systems. Carbofuran is highly toxic to bees, birds, fish, mammals and other wildlife. It may kill birds and pollinating bees on direct exposure. Its use may be hazardous in the foraging and nesting habitats of rare species. It should not be applied when and where they actively forage or nest. The routes of wildlife exposure can be: ground and aerial spraying, spray drift, contact with treated soil, and ingestion of treated plant or contaminated tissue. For waterfowl protection, it may not be applied immediately before and during irrigation, or on fields in the proximity of waterfowl nesting and foraging areas. Its application and discharge to or near surface-water streams, ponds, bogs or rivers, and where spray drift may occur to non-target habitats should be avoided. Strict adherence to the label directions, and responsible usage should decrease the chances of adverse effects on wildlife and other natural resources.

### **ENVIRONMENTAL FATE**

Carbofuran, the active ingredient in Furadan 4F, has a molecular weight of 221.3. Its water solubility is high at 700 ppm, and has variable solubility in organic solvents. The vapor pressure of carbofuran is moderately high at  $2 \times 10^{-5}$  at 33°C. The Henry's Law Constant is  $8.3 \times 10^{-6}$ , which is another indicator of moderate volatility.

## Degradative Processes

**Hydrolysis:** Rates of hydrolysis of carbofuran are dependent on temperature and pH. Studies have shown rates of <24 hours at pH 9-9.9, 70 hours at pH 8.1, and 504-653 hours at pH 7-7.1 (all at 25°C).

**Photolysis:** Photolysis studies indicate that degradation is moderately rapid in sterile water. The half-life in unbuffered water is 4.2 days, and 5.6 days in buffered (pH7) water. Another study showed 24-35 % of extractable  $^{14}\text{C}$ -labeled carbofuran was lost after 6 days in sterile soil. However, 14% was lost in the same study when samples were held in the dark.

**Soil Degradation:** It is difficult to generalize about the soil degradation half-life of carbofuran due to the significant influence of temperature and pH. Persistence increases with decreasing temperature and decreasing pH. Studies have shown half-lives of 20-40 days in three different soil types. The major metabolite is 3-hydroxycarbofuran. Several other studies report half-lives from 3 days to a calculated value of 350 days.

## Adsorption and Mobility

**Adsorption:** The soil adsorption coefficient ( $K_{ow}$ ) varies from 0.01 to 2.22 in a variety of soils, indicating low adsorption. Carbofuran is not strongly adsorbed to organic matter. However multiple linear regression analysis shows that 98% of total soil adsorption is attributable to the organic matter component of soil. The remainder is adsorbed to the mineral component.

**Mobility:** Generally, studies have shown carbofuran to have high mobility. The  $K_{oc}$  for carbofuran is 1-63, indicating a very high to high mobility. This is consistent with the above adsorption discussion.  $R_f$  values in sand and sandy loam are reported at 0.9- 0.95 (very mobile); in silt loam and silty clay loams at 0.75-0.77 (mobile); and decreasing to  $R_f$  0.3 (low mobility) in muck soil with 16.8% organic carbon.

## Field Dissipation

Dissipation rates of carbofuran vary considerably, with relatively rapid half-lives 4 days to long half-lives of <5 months. It is influenced by soil moisture, timing of rainfall events, soil pH, and application method.

## Ground Water Concerns

Carbofuran is weakly adsorbed; it is mobile and very water soluble. Consequently it has a high probability of leaching. However, environmental conditions may strongly influence the rate of carbofuran degradation, thus influencing the potential for ground-water contamination. Carbofuran has been reported in ground water as a result of agricultural use in several states.

## Summary

In summary, carbofuran undergoes rapid hydrolysis under alkaline conditions, while it is relatively stable under neutral and acidic conditions. It photodegrades fairly rapidly in water and soil. Degradation under field conditions has yielded variable results due to the strong influence of local environmental conditions and methods of application. High water solubility, weak adsorption and high mobility give carbofuran the potential to contaminate ground water. Label restrictions and precautions must be strictly followed to avoid possible ground and surface water contamination.

### **POSSIBLE RISKS POSED BY THE USE**

Carbofuran is an acute toxin that inhibits cholinesterase and stimulates central, parasympathetic and somatic motor systems. Incidence where direct skin contact may occur should be avoided. Carbofuran is highly toxic to bees, birds, fish, mammals and other wildlife. It may kill birds and pollinating bees on direct exposure. Its use may be hazardous in the foraging and nesting habitats of threatened and endangered species.

### **PROPOSALS TO MITIGATE RISKS**

Protective clothing (hand gloves, hat or suitable head covering, coverall type shirt and pants, shoes and socks) and goggles when contacting or applying carbofuran. Exposure limit (8-h) established by OSHA for carbofuran is  $0.1 \text{ mg/m}^3$  in an occupational setting. A minimum 48 hour reentry interval applies after each use of Furadan 4F because of possible high dermal toxicity (Category I) as established under federal Worker Protection Standards. However, in areas especially in west Texas where the annual rainfall may be below 25 inches, the reentry interval will be extended to 72 hours. Do not enter the treated field before the prescribed reentry interval. In the case of prolonged contact with cotton during the reentry period, use protective clothing. The cotton forage from treated fields should not be fed to cattle.

Carbofuran can pose a threat to pollinating bees, birds and other wildlife. It should not be applied when and where they actively forage or nest. The routes of wildlife exposure can be: ground and aerial spraying, spray drift, contact with treated soil, and ingestion of treated plant or contaminated tissue. For waterfowl protection, it may not be applied immediately before and during irrigation, or on fields in the proximity of waterfowl nesting and foraging areas. Its application and discharge to or near surface-water streams, ponds, bogs or rivers, and where spray drift may occur to non-target habitats should be avoided. Strict adherence to the label directions, and responsible usage should decrease the chances of adverse effects on wildlife and other natural resources. Local Texas Agricultural Extension Service agent, Fish Wildlife Service or Parks and Wildlife Department may be consulted for the current delineation of endangered and threatened species habitats to ensure compliance with label restrictions.

### **SECTION 166.20(a)(8): COORDINATION WITH OTHER AFFECTED FEDERAL/STATE AGENCIES**

The following State/Federal agencies were notified, of the Texas Department of Agriculture's intent to submit this application for a specific exemption application:

- Texas Environmental Quality Commission, Air Quality Control Team
- Texas Environmental Quality Commission, Ground Water Protection
- Texas Parks and Wildlife Department
- Texas Department of Health
- U.S. Fish and Wildlife Service

Response from agencies will be forwarded to EPA when and if received by the department.

#### **SECTION 166.20(a)(9): NOTIFICATION OF REGISTRANT**

The registrant, FMC Corporation, has been notified of the pesticide requested for this specific exemption.

#### **SECTION 166.20(a)(10): PROPOSED ENFORCEMENT PROGRAM**

The State Legislature has endowed the Texas Department of Agriculture with the authority to regulate the distribution, storage, sale, use and disposal of pesticides in the state of Texas. In addition, the EPA/TDA grant enforcement agreement provides the Department with the authority to enforce the provisions of the FIFRA, as amended, within the state. Therefore, the Department is not lacking in authority to enforce the provisions of an EPA approved specific exemption.

If this specific exemption request is approved, TDA Pesticide Enforcement Inspectors will make a number of random, unannounced calls on both growers and applicators to check for compliance with the provisions of the specific exemption.

If violations are discovered, appropriate enforcement action will be taken.

#### **SECTION 166.20(a)(11): REPEAT USES**

The final report for 02-TX-06 was mailed to EPA on February 11, 2003.

#### **SECTION (166.25(b)(2)(ii) PROGRESS TOWARD REGISTRATION**

Please refer to letter from FMC Corporation dated 1/07/03 addressing the current status of progress towards registration (Section 8). A complete application for a FIFRA Section 3

registration was submitted for this use in March, 1995, by the registrant. Additional new data was submitted to EPA by the registrant FMC Corporation to support carbofuran registration and was included in the package for 2002. (See the 2002 application for these details dated 2/8/99, 12/10/98 and a letter to Mr. Jerry Campbell, California DPR on August 11, 1997.)

## **SECTION 166.20(b): REQUIRED INFORMATION**

### **Section 166.20(b)(1)**

Scientific and Common Name of the Pest:

**Scientific Name:** *Aphis gossypii*, Glover

**Common Name:** Cotton Aphid

## **SECTION 166.20(b)(2): DISCUSSION OF EVENTS OR WHICH BROUGHT ABOUT THE EMERGENCY CONDITION**

Please refer to the article, *Management of Cotton Aphids: Texas Style*, (Section 6). This report thoroughly addresses the factors, primarily pesticide resistance, which has brought about the need for Furadan 4F in the past. Please also refer to correspondence from Blake Layton, extension entomologist from Mississippi, (Section 8). Dr. Layton considers the availability of Furadan, as an option, essential in helping to preserve the longevity of the other newly labeled products. To make the carbamate: Furadan, available as an option is a "Resistance Management" approach that could preserve a number of new alternate chemistry vital to the control of this pest for the future.

## **SECTION 166.20(b)(4): DISCUSSION OF ECONOMIC LOSS**

The discussion of "Economic Loss," used previously, is still valid because those same losses will be incurred after the newly labeled products become ineffective as a result of repeated use and the development of resistance. These numbers are considered to represent the losses incurred in areas where 2 or more applications are needed on the same field population this year. In those situations, resistance is expected. Historical production statistics, including net revenues for the site as a whole and net and gross revenues on a per acre basis, is presented in a table (Section 7 of this application). These revenues were calculated using the annual national target price for cotton, "which was a program crop" along with production records from the state of Texas. These production records were obtained from the Texas Agricultural Statistics Service for all upland cotton (irrigated and non-irrigated cotton). Projected production costs were figured as a weighted average between irrigated and nonirrigated upland cotton due to differences in production costs. These production costs are from the Texas Agricultural

Extension Service's Texas Crop Enterprise Budgets for the years 1991-1995. Please note that there was a significant yield reduction per harvested acre in 1995, which caused a significant loss in net revenue in this table. This yield loss was caused by the significant increase in harvested acres (one half million) and severe losses in some areas due to insects, such as beet armyworms, cotton aphids and weather (drought). There are two factors in presenting the net and gross revenues with and without the requested pesticide, but with the next best alternatives, these are 1. yield loss and 2. production cost. An aspect of yield loss that should be explained is how yield losses appear diminished, when averaged on a large acreage crop such as cotton in Texas. Included in Section 7 is a summary of cotton insect losses in 1993 published for the 1994 Beltwide Cotton Conferences. The background statement explains how data is averaged over a total reporting unit/state and gives the following classic example of averaging losses: "if a unit report represents 100 acres and 25 of those acres have an 8% loss, then in the summary there is a 2% loss shown  $((.08 \times 25)/100)$ ." This averaging along with consultation with professional entomologists was used to arrive at the 1.8 million acres (35% of the cotton harvested in Texas in 1994) that may need treatment of FURADAN 4F Insecticide.

### **Factor 1. Yield loss**

The effect of using currently labeled products consecutively on the same aphid population or repeatedly on multiple generations of the cotton aphid is devastating. This is the reason that both product manufacturers recommend against it on their labels. Based on the expected outcome of aphid control failures or effects less than 80% control; the previously submitted data on the yield loss effects following insecticide failures will remain the same as was submitted last year. Although yield losses as high as 50% have been reported in cotton fields, an estimated yield loss of 8% was used for the economic analysis table presented in Section 7. This was derived by using documented information from the extension service in which high and low density populations of cotton aphid were compared for their effect on yield and quality of cotton (Section 7). BIDRIN (dicotophos), which is considered the best registered alternative, was used to control aphid populations and compared with no control. This resulted in a yield difference of 16%. According to three different crop consultants in 1997, (personal communication) from around the state, BIDRIN offers from 30% to 60% control of cotton aphids compared to FURADAN 4F at 99% control (Section 8). Using this information and assuming that BIDRIN offered 50% control on the average, it is conservative to estimate an average 8% yield loss comparing dicotophos with carbofuran.

**Factor 2. Production cost (application costs)** The cost for two applications (chemical \$3.125 x 2 + application \$3.50 x 2) of the requested pesticide on one acre is \$13.25. According to crop consultants, typically used are two applications of BIDRIN, an application of LANNATE and an application of LORSBAN to get the same needed control as two applications of FURADAN 4F Insecticide, although sometimes this is not enough. All discussions with crop consultants indicated a similar "pesticide mix" for pest management reasons to prevent pesticide resistance. These four applications would cost (chemical, BIDRIN \$5.31 x 2, LANNATE \$9.74 and LORSBAN \$5.74 + application \$3.50 x 4) a total of \$40.10 per acre. This is a \$26.85 per acre difference in additional production costs without the use of carbofuran. This translates to an additional 48 million dollars in extra pesticide purchases and application costs the grower must pay exclusive of any yield loss. Using the table in section 8, the combined net loss of both yield

# Economic Analysis for All Upland Cotton in the Requested Site

Year	Yield/ Harvested Acre in cwt. a/	Target price per lb. b/	Gross Revenue \$/Acre	Production Cost \$/Acre c/	Net Revenue \$/Acre	Net Revenue of Requested Site (\$/Acre million) d/
1990	477	.729	348	290	58	104.4
1991	419	.729	305	295	10	18
1992	441	.729	321	297	24	43.2
1993	484	.729	353	291	62	111.6
1994	466	.729	340	340	0	0
Average	457	.729	333	303	30	54
With Requested Pesticide	457	.729	333	303	30	54
Without Requested Pesticide	420 e/	.729	306	329.85 f/	(23.85)	(42.9)

a/ Source, Texas Agricultural Statistics Service (TASS).

b/ U.S.D.A. National Target Price

c/ Texas Agriculture Extension Service, Texas Crop Enterprise Budgets (TAEX)

d/ TAEX, Estimated 35% of total acres in requested site(1.8 million acres)

e/ Estimated 8% yield loss

f/ Estimated \$26.85 increase in additional pesticide purchases and application costs

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loss and increased production cost would be a \$23, 85 per acre or a 43 million dollar net loss in the requested site (the state of Texas). When compared to the average net revenue of 54 million dollars, a net loss of 97 million dollar could be realized with the use of the requested pesticide.

Another aspect of economic losses which is not addressed in the table or in production costs is the loss of lint quality due to "sticky lint" from cotton aphid honeydew. Although this is apparently not as significant a problem as with the sweetpotato whitefly, and is difficult to document, it does exist. It effects not only the price of cotton the producer would otherwise receive, but creates ginning problems and problems for the cotton textile industry. Enclosed is a letter from Paul Reinhart, Inc. the largest seller of cotton in Texas, which supports this claim (Section 7). Also included is a newspaper article dated January 23, 1997. The lead statement is "Clean up your sticky lint problem, local producers were warned or a mill that bought \$103 million worth of West Texas cotton...will look elsewhere.

<b>SECTION 166.20(b)(4)(ii)&amp;(iii): ESTIMATED REVENUES FOR THE SITE TO BE TREATED</b>
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**Estimated net and gross revenues without the use of proposed pesticide (but with next best alternative)**

It is estimated that the net revenue without the proposed pesticide (but with the next best alternative) would be a loss of \$21.00 per acre (a 108 million dollar loss for the site) with an 10% yield loss and additional pesticide purchases and application costs. The gross revenue would be \$308.07 per acre (for the site, 554 million dollars).

**Estimated net and gross revenues with the use of the proposed pesticide:**

It is estimated that the net revenue with the proposed pesticide would be \$11.23 per acre (for the site 20.2 million dollars. The gross revenue would be \$340.23 per acre (612 million dollars for the site ).

These differences indicate a \$32.16 per acre loss in net revenue, which translates to a 58 million dollar loss in net revenue for the requested site.